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Contributions towards an understanding of the Cryptophaginae (Coleoptera, Cryptophagidae) of Atlantic Canada

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Abstract

Eighteen species of Cryptophaginae are now known to occur in Atlantic Canada. Eight of these including *Cryptophagus difficilis* Casey, *Cryptophagus jakowlewi* Reitter, *Cryptophagus laticollis* Lucas, *Cryptophagus mainensis* Casey, *Cryptophagus tuberculosus* Mäklin, *Pteryngium crenatum* (Gyllenhal), *Telmatophilus americanus* LeConte and *Caenoscelis basalis* Casey, are newly recorded in Atlantic Canada; one of which, *C. mainensis*, is newly recorded in Canada, and another, *C. laticollis*, is newly recorded in eastern North America. Nineteen new provincial records are reported with the result that five species of Cryptophaginae are now known from New Brunswick, 14 from Nova Scotia, four from Prince Edward Island, 10 from insular Newfoundland, and four from Labrador. A new early date of detection (1986) is reported for the adventive Palaearctic *Telmatophilus typhae* (Fallén) in North America. Keys to identification are provided for the genera *Antherophagus, Cryptophagus,* and *Telmatophilus* and the composition, zoogeography, and bionomics of the group in Atlantic Canada are discussed.

Keywords

Cryptophagidae, Cryptophaginae, *Antherophagus, Cryptophagus, Henoticus, Henotiderus, Pteryngium, Telmatophilus, Caenoscelis*, Atlantic Canada, New Brunswick, Newfoundland and Labrador, Nova Scotia, Prince Edward Island, biodiversity, zoogeography, bionomics, keys to identification, adventive species

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Introduction

The Cryptophaginae is the nominate subfamily of the Cryptophagidae (the silken fungus beetles). Most species feed on fungal hyphae, spores, and conidia while others are saprophagous. They are typically found in decaying organic materials that are colonized by fungi. Some species of *Cryptophagus* are found on a variety of stored products. Members of the genus *Antherophagus* are phoretic on bumble bees (*Bombus* spp.) whereas species in the genus *Telmatophilus* are associated with the flowers of various aquatic plants (Leschen and Skelley 2002).

Leschen and Skelley (2002) included 53 species in nine genera in the North American fauna. In Canada, Bousquet (1991) listed 42 species, although only 7 of these were recorded from Atlantic Canada (the provinces of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador). The present study contributes further records of species of this family from the region, provides keys to identification of species in the genera *Antherophagus, Cryptophagus, Henotiderus,* and *Telmatophilus* in the region, and discusses the composition, zoogeography, and bionomics of the group in Atlantic Canada.

Methods and conventions

Specimens of Cryptophaginae originating from Atlantic Canada in a variety of collections were examined and identified. These collections yielded 766 specimens; 195 from Nova Scotia, 21 from New Brunswick, 49 from Prince Edward Island, and 501 from Newfoundland and Labrador. Abbreviations (largely following Evenhuis 2009) of collections that contributed specimens or data to this study are:

AAFC Agriculture and Agri-Food Canada, St. John's, Newfoundland and Labrador, Canada
ACNS Agriculture and Agri-Food Canada, Kentville, Nova Scotia, Canada
ACPE Agriculture and Agri-Food Canada, Charlottetown, Prince Edward Island, Canada
CBU Cape Breton University, Sydney, Nova Scotia, Canada
CFS Canadian Forest Service, Corner Brook, Newfoundland and Labrador, Canada
CGMC Christopher G. Majka collection, Halifax, Nova Scotia, Canada
CNC Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
CUIC Cornell University Insect Collection, Cornell University, Ithaca, New York, United States
DHWC David H. Webster collection, Kentville, Nova Scotia, Canada
JCC Joyce Cook collection (now at the New Brunswick Museum)
JOC Jeffrey Ogden collection, Truro, Nova Scotia, Canada

MUN	Memorial University of Newfoundland collection, St. John's, Newfoundland and Labrador, Canada (currently on long term loan to the Canadian Forest Service, Edmonton, Alberta)
MZHF	Zoological Museum, University of Helsinki, Helsinki, Finland
NBM	New Brunswick Museum, Saint John, New Brunswick, Canada
NSMC	Nova Scotia Museum, Halifax, Nova Scotia, Canada
NSNR	Nova Scotia Department of Natural Resources, Shubenacadie, Nova Scotia, Canada
RWC	Reginald Webster collection, Charters Settlement, New Brunswick, Canada
UMNB	Université de Moncton, Moncton, New Brunswick, Canada

In the species treatments, the number of specimens and the collection abbreviation are indicated in parentheses. Abbreviations used in the keys and listing of species are: L, body length; FIT, flight intercept trap; uv, ultra violet light.

Identification and taxonomy

The keys provided by Bousquet (1989) and Leschen and Skelley (2002) readily allow the identification of specimens to generic level.

Antherophagus. Northeastern North American species of *Antherophagus* Latreille can be identified with the following key (adapted from Downie and Arnett 1996: 1005):

Key A. Species of *Antherophagus*

1. Length over 4.0 mm; habitus broadly oblong. L. 4.0–5.0 mm ..... ***Antherophagus ochraceus***

– Length less than 3.5 mm; habitus narrowly oblong. L. 3.3 mm..... ***Antherophagus convexulus***

Cryptophagus. Identifying *Cryptophagus* specimens to species level is fraught with difficulty. Many species are highly variable, and according to Woodroffe and Coombs (1961), variation in the North American fauna far exceeds that of European species. Certain species exhibit a high degree of local differentiation, there are polytypic species, and some species-complexes show intermediate forms between what are otherwise distinct species. There are variations in character states (such as the position of the lateral tooth on the pronotum), and in some species the adeagi exhibit few distinctive features. Some character states, such as the shape of the lateral margins, are based on very subtle differences. Where quantitative measurements are used to help distinguish species, it is likely that some specimens will fall outside the normal range. As a result there are some species that "… are found to be so nearly indistinguishable that their correct identification on external characters becomes more of an art than a science." (Woodroffe and Coombs 1961: 183).

The keys, detailed descriptions, and illustrations of external anatomy and genitalia provided by Woodroffe and Coombs (1961) are indispensable for the identification of species of *Cryptophagus*. A simplified key to the species of *Cryptophagus* found thus far in Atlantic Canada (modified from Woodroffe and Coombs 1961: 186–189) is presented below:

Key B. Species of *Cryptophagus*

1. Elytral pubescence single, entirely decumbent with hairs of approximately equal length **2**
– Elytral pubescence double, with longer sub-erect or obliquely raised hairs, sometimes arranged in rows, in addition to decumbent pubescence; or all hairs obliquely raised and uneven in length **6**
2(1). Pronotal callosities strongly produced laterally so that pronotum is much wider across callosities than across lateral teeth; lateral tooth often very large (ratio of tooth projection from lateral margin/length of callosity: ~ 40%). L. 1.9–2.8 mm ..... ***Cryptophagus acutangulus***
– Pronotal callosities much less strongly produced, pronotum not or slightly wider across callosities than across lateral teeth; lateral tooth small to medium-sized (ratio of tooth projection from lateral margin/length of callosity: 13–24%) **3**
3(2). Face of apical pronotal callosity projecting out from lateral margin of pronotum, delimited posteriorly by a distinct angle **4**
– Face of apical pronotal callosity not projecting out from lateral margin of pronotum, posteriorly contiguous with lateral pronotal margin **5**
4(3). Pronotum noticeably narrower than elytra (ratio of elytra at humeri to pronotum at middle ~ 1.0:1.2), almost parallel-sided, appearing quadrate (width to height ratio ~ 1.0:1.2). L. 2.2–3.3 mm ..... ***Cryptophagus fallax***
– Pronotum not or only slightly narrower than elytra (ratio ~ 1.0:1.0), with arcuate lateral margins, distinctly transverse (ratio ~ 1.0:1.5). L. 2.0–2.7 mm ..... ***Cryptophagus jakowlewi***
5(3). Usually bi-coloured, pronotum and elytral humeri reddish, remainder of elytra darker; pronotal callosities large (~ 1/4 of lateral margin), upturned, and not projecting anteriorly; lateral margin of pronotum strongly concave between callosity and lateral tooth. L. 2.0–2.8 mm ..... ***Cryptophagus scanicus***
– Unicoloured red-brown; pronotal callosities smaller (~ 1/5 of lateral margin), not upturned and projecting strongly anteriorly; lateral margin of pronotum slightly concave between callosity and lateral tooth. L. 2.0–2.8 mm ..... ***Cryptophagus tuberculosus***
6(1). Posterior edge of rim of pronotal callosity with a small posteriorly projecting rim tooth; flightless, most specimens with vestigial wings. L. 2.1–2.8 mm ..... ***Cryptophagus difficilis***
– Posterior edge of rim of pronotal callosity without rim tooth; with full-sized wings 7

7(6). Pronotal callosity very large (~ 1/3 of lateral margin); length ≤ 1.7 mm; antennal club with basal segment (article 9) distinctly narrower than middle segment (article 10). L. 1.5–1.7 mm ..... ***Cryptophagus mainensis***

– Pronotal callosity smaller (~ 1/4 or less of lateral margin); length ≥ 1.7 mm; antennal club with articles 9 and 10 of approximately the same width **8**

8(7). Eyes small, conical, and somewhat flattened anteriorly; anterior elytral punctation significantly finer and more widely spaced than pronotal punctuation; generally smaller, most individuals ≤ 2.0 mm. L. 1.7–2.4 mm ..... ***Cryptophagus laticollis***

– Eyes normal to large; anterior elytral punctation almost as large and dense as pronotal punctuation; generally larger, individuals ≥ 2.0 mm..... **9**

9(8). Pronotal callosity generally smaller (1/5–1/6 of lateral margin) with weak dorsal rim, usually not prominent anteriorly. L. 2.5–3.0 mm..... ***Cryptophagus histricus***

– Pronotal callosity generally larger (1/4–1/6 of lateral margin), usually thickened with strong dorsal rim, frequently prominent anteriorly. L. 2.0–3.0 mm..... ***Cryptophagus setulosus***

Henoticus. There is only a single species of *Henoticus* Thomson in northeastern North America, *H. serratus* (Gyllenhal).

Henotiderus. The Nearctic *Henotiderus hirtus* Casey, 1900 and *Henotiderus obesulus* Casey, 1900 were synonymized by Johnson et al. (2007) with the eastern Palearactic *Henotiderus centromaculatus* Reitter, 1877 to form one Holarctic species.

Pteryngium. There is only a single species of *Pteryngium* Reitter found in North America, *P. crenatum* (Gyllenhal).

Telmatophilus. North American species of *Telmatophilus* Heer can be identified with the following key (adapted from Hoebeke and Wheeler 2000: 399):

Key D. Species of *Telmatophilus*

1. Body length 2.5–3.0 mm; meta-tibia of male with an external flange-like expansion at the base; male with a deep oval pit at the apex of the fifth (last) visible abdominal ventrite ..... ***Telmatophilus americanus***

– Body length 1.9–2.6 mm; meta-tibia of male without any flange-like expansion; male with a feeble depression at the apex of the fifth (last) visible abdominal ventrite..... ***Telmatophilus typhae***

Caenoscelis. The six species of *Caenoscelis* Thomson found in northeastern North America can be identified with the key provided in Downie and Arnett (1996: 1010–1011).

Results

Eighteen species of Cryptophaginae are now known to occur in Atlantic Canada. Nine of these including *Cryptophagus difficilis* Casey, *Cryptophagus jakowlewi* Reitter, *Cryptophagus laticollis* Lucas, *Cryptophagus mainensis* Casey, *Cryptophagus tuberculosus* Mäklin, *Pteryngium crenatum* (Gyllenhal), *Telmatophilus americanus* LeConte, and *Caenoscelis basalis* Casey are newly recorded in Atlantic Canada; *C. mainensis*, is newly recorded in Canada, and *C. laticollis*, is newly recorded in eastern North America. Nineteen new provincial records are reported, with the result that five species of Cryptophaginae are now known from New Brunswick, 14 from Nova Scotia, four from Prince Edward Island, 10 from insular Newfoundland, and four from Labrador (a total of 11 species from the province of Newfoundland and Labrador) (Table 1). A new early date of detection is reported for the adventive Palaearctic *Telmatophilus typhae* (Fallén) in North America; 1986, nine years earlier than previously known. The fauna is discussed in greater detail below, with records of new jurisdictional records provided.

Antherophagus convexulus LeConte, 1863

Antherophagus convexulus was reported from both New Brunswick and Nova Scotia by Bousquet (1991). There are a number of records from both the mainland of Nova Scotia and Cape Breton Island (Fig. 1), however, we have not been able to locate voucher specimens or published records of this species from New Brunswick. We provisionally retain this species for the New Brunswick fauna (subject to confirmation) since it is also known from the neighbouring jurisdictions of Québec and Maine (Procter 1946; Laplante et al. 1991), and is to be expected in the province. *Antherophagus* species are phoretic on bumblebees (*Bombus* spp.) and are often found in their nests or at flowers where their larvae apparently feed on organic detritus (Bousquet 1989; Leschen and Skelley 2002).

Antherophagus ochraceus Melsheimer, 1844

Antherophagus ochraceus was reported from New Brunswick, Nova Scotia, Prince Edward Island, and insular Newfoundland by Bousquet (1991) and it is widely distributed in the region (Fig. 1). *Antherophagus* species are associated with bumblebees (*Bombus* spp.) (see *A. convexulus*). Blatchley (1910) reported this species from the flowers of *Hydrangea arborescens* L. (Hydrangeaceae). In Nova Scotia there are several records from the flowers of *Rosa virginiana* Mill. (Rosaceae).

Table 1. The Cryptophaginae of Atlantic Canada.

	NB	NS	PE	NF	LB	Distribution in NE North America
Cryptophagini						
Antherophagus convexulus LeConte	1	1				ME, NB, NS, ON, QC
Antherophagus ochraceus Melsheimer §	1	1	1	1		MA, ME, NB, NF, NH, NS, ON, PE, QC, RI
Cryptophagus acutangulus Gyllenhal §		1		1		CT, MA, ME, NF, NH, NS, NY, ON, QC
Cryptophagus difficilis Casey				1	1	LB, NF, QC
Cryptophagus fallax Balfour-Browne †	1	1	1			ME, NB, NS, PE
Cryptophagus histricus Casey					1	LB
Cryptophagus jakowlewi Reitter *		1	1			NS, PE, QC
Cryptophagus laticollis Lucas †		1				NS
Cryptophagus mainensis Casey		1		1		ME, NF, NH, NS, NY
Cryptophagus scanicus (Linnaeus) †				1		NF
Cryptophagus setulosus Sturm §				1	1	LB, NF, NY, ON, QC
Cryptophagus tuberculosus Mäklin *		1		1		ME, NF, NH, NS
Henoticus serratus (Gyllenhal) *		1		1	1	LB, MA, NF, NH, NS, ON, QC, RI
Henotiderus centromaculatus Reitter *		1				NH, NS, ON, QC
Pteryngium crenatum (Gyllenhal) †		1				NH, NS, QC
Telmatophilus americanus LeConte	1	1		1		MA, ME, NB, NF, NH, NS, ON, QC
Telmatophilus typhae (Fallén) †	1	1	1			NB, NS, PE
Caenoscelini						
Caenoscelis basalis Casey		1		1		ME, NF, NH, NS, NY, QC
Total	**5**	**14**	**4**	**10**	**4**	

Notes: †, adventive Palaearctic; *, Holarctic; §, probably Holarctic; no symbol, Nearctic.
For the purposes of this treatment, northeastern (NE) North America is taken to consist of the following jurisdictions: CT, Connecticut; LB, Labrador; MA, Massachusetts; ME, Maine; NB, New Brunswick; NF, insular Newfoundland; NH, New Hampshire; NS, Nova Scotia; NY, New York; ON; Ontario; PE, Prince Edward Island; QC, Québec; RI, Rhode Island; PM, Saint-Pierre et Miquelon; and VT, Vermont.

Cryptophagus acutangulus Gyllenhal, 1827

NOVA SCOTIA: Halifax Co.: Dartmouth, January 27, 1987, D. Seguin (1, NSMC); Halifax, December 11, 1990, P. Hyslop (2, NSMC); Halifax, July 18, 2002, D. Holland (3, NSMC); Halifax, December 4, 1989, J. Newman (1, NSMC); Halifax, July 23, 1991, collector not recorded (5, NSMC); Halifax, July 18, 2002, D. Holland (1, NSMC); Halifax, July 6, 1992, D. McCarthy (3, NSMC); **Kings Co.:** Kentville, July 10, 1965, C.J.S. Fox (1, ACNS); Kentville, July 10, 1965, C.J.S. Fox (1, ACNS); **Richmond Co.:** Lake Uist, July 3–6, 1990, B. Wright, feeding on dead horsefly (21, NSMC).

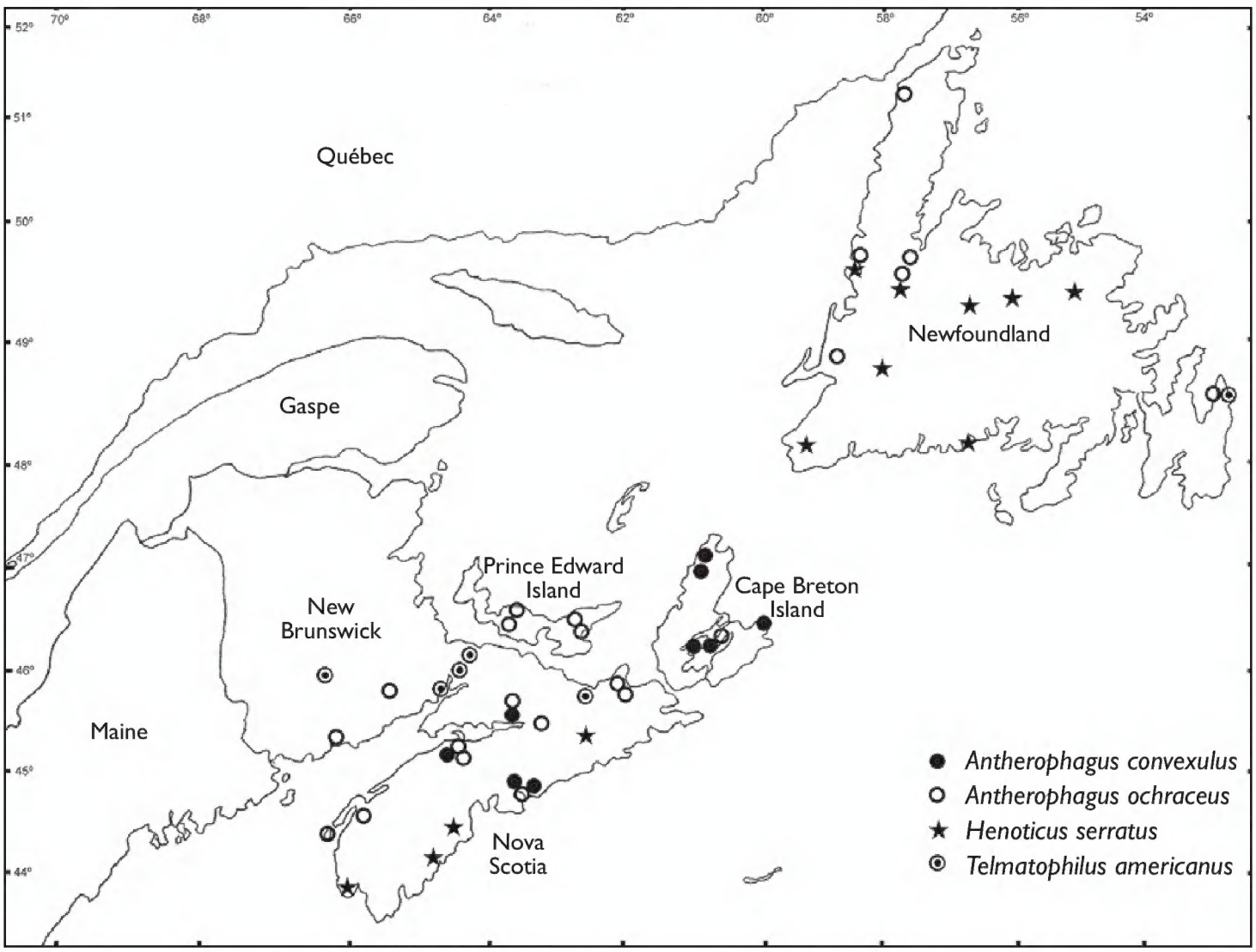

Figure 1. Distribution of *Antherophagus convexulus, Antherophagus ochraceus, Henoticus serratus,* and *Telmatophilus americanus* in Atlantic Canada.

Cryptophagus acutangulus is newly recorded in Nova Scotia, on both the mainland of the province and Cape Breton Island. It was reported previously from insular Newfoundland by Bousquet (1991) (Fig. 4). It is probably a Holarctic species, generally distributed in North America (Woodroffe and Coombs 1961). Woodroffe and Coombs (1961) noted that in Europe this species occurs on stored produce and it is possible that its North American distribution may have been influenced by commercial activities. In the Palaearctic region it is found throughout Europe, in North Africa, across the Middle East and Caucasus, through Central Asia, the Russian Far East, south to Japan, North Korea, and China. It is also found in sub-Saharan Africa and the Neotropical Region (Johnson et al. 2007). It occurs both on stored products and in wild habitats (Woodroffe and Coombs 1961). A very distinctive species on account of the strongly produced lateral pronotal callosities.

Cryptophagus difficilis Casey, 1900

LABRADOR: Goose Bay, military base, July 28-August 6, 2008, G.R. Pohl & D.W. Langor, weedy *Salix*/grass clearing, pitfall (1, MUN); Middle Brook, June 2–17, 2005, July 4–18, 2005, July 18–2, August 2–11, 2005, August, 2005, August 11–24, 2005,

August 24-September 12, 2005, S. Pardy, boreal forest, pitfall (73, MUN); Muskrat Falls, June 2–17, 2005, June 17-July 5, 2005, July 5–19, 2005, July 19-August 3, 2005, August 3–12, 2005, August 12–25, 2005, August 25-September 13, 2005, S. Pardy, boreal forest, pitfall (215, MUN); Muskrat Falls, July 31, 2008, G.R. Pohl & D.W. Langor, wooded trails, ex mushrooms (3, MUN); Ossak Camp, August 11–29, 2004, September 22-October 8, 2004, September 27-October 8, 2004, S. Pardy, subarctic black spruce forest, pitfall (7, MUN); Port Hope, July 22-August 5, 2004, August 5–25, 2004, August 25-September 13, 2005, S. Pardy, subarctic black spruce forest, pitfall (22, MUN); St. Lewis, July 5–22, 2004, August 10–25, 2004, August 25-September 7, 2004, S. Pardy, coastal barrens, heath, pitfall (16, MUN). **NEWFOUNDLAND:** Baker's Brook, Gros Morne National Park, July-August, 2000, N. Chalk (7, MUN); Burnt Cape, July 24–7 August, 2003, August 7–21, 2003, A.M. Hynes, cow parsnip patch, pitfall (2, MUN); Burnt Cape, July 24–7 August, 2003, A.M. Hynes, shoreline, pitfall (1, MUN); Gambo, August 26, 1949, E. Palmen (6, MZHF); Glide Lake, August 30, 1994, W. Bowers (1, CFS); St. John Island, August 3, 1949, C.H. Lindroth (1, MZHF); St. John's, September-November, 1994, Biology 4150 (3, MUN); St. John's, September 30, 1997, J. Coombes (1, AAFC); Windsor Lake, August 30, 1977, D. Larson (5, MUN).

Cryptophagus difficilis is newly recorded in insular Newfoundland, Labrador and in Atlantic Canada (Figs. 3, 6). In Canada, previous records of the species are from British Columbia, Alberta, the Yukon, and Québec; in the United States it has been found from Idaho to New Jersey, and south to Georgia (Woodroffe and Coombs 1961). In British Columbia it has been collected from fungus (Woodroffe and Coombs 1961). It is a flightless species, and in most of the specimens examined from this region, the wings were vestigial (although one specimen had reduced wings equal to approximately half the length of the abdomen).

Cryptophagus fallax Balfour-Browne, 1953

NEW BRUNSWICK: Westmorland Co.: Moncton, November 24, 1982, Pest Control (1, UMNB); Moncton, September 14, 1982, S.R. Michaud (1, UMNB); Moncton, September 14, 1982, S.R. Michaud (1, UMNB). **NOVA SCOTIA: Halifax Co.:** Halifax, June 30, 1989, N. Patterson (3, NSMC). **PRINCE EDWARD ISLAND: Prince Co.:** Summerside, June 6, 1988, M. Drake, in house (3, ACPE); **Queens Co.:** Charlottetown, September 24, 1981, L.S. Thompson (5, ACPE); Charlottetown, summer, 1991, J.G. Stewarton (1, ACPE); Charlottetown, July 15, 1985, M.E.M. Smith (1, ACPE); Charlottetown, June 20, 1988, M.E.M. Smith, in house (2, ACPE); Charlottetown, June, 1973, collector not recorded (2, CNC); Earnscliffe, September 7, 1983, M.E.M. Smith, in house (1, ACPE); Mount Stewart, June 10, 1976, L.S. Thompson (5, ACPE).

Cryptophagus fallax is newly recorded in New Brunswick (Fig. 2). Previous North American records are from Maine (Woodroffe and Coombs 1961), Sable Island, Nova

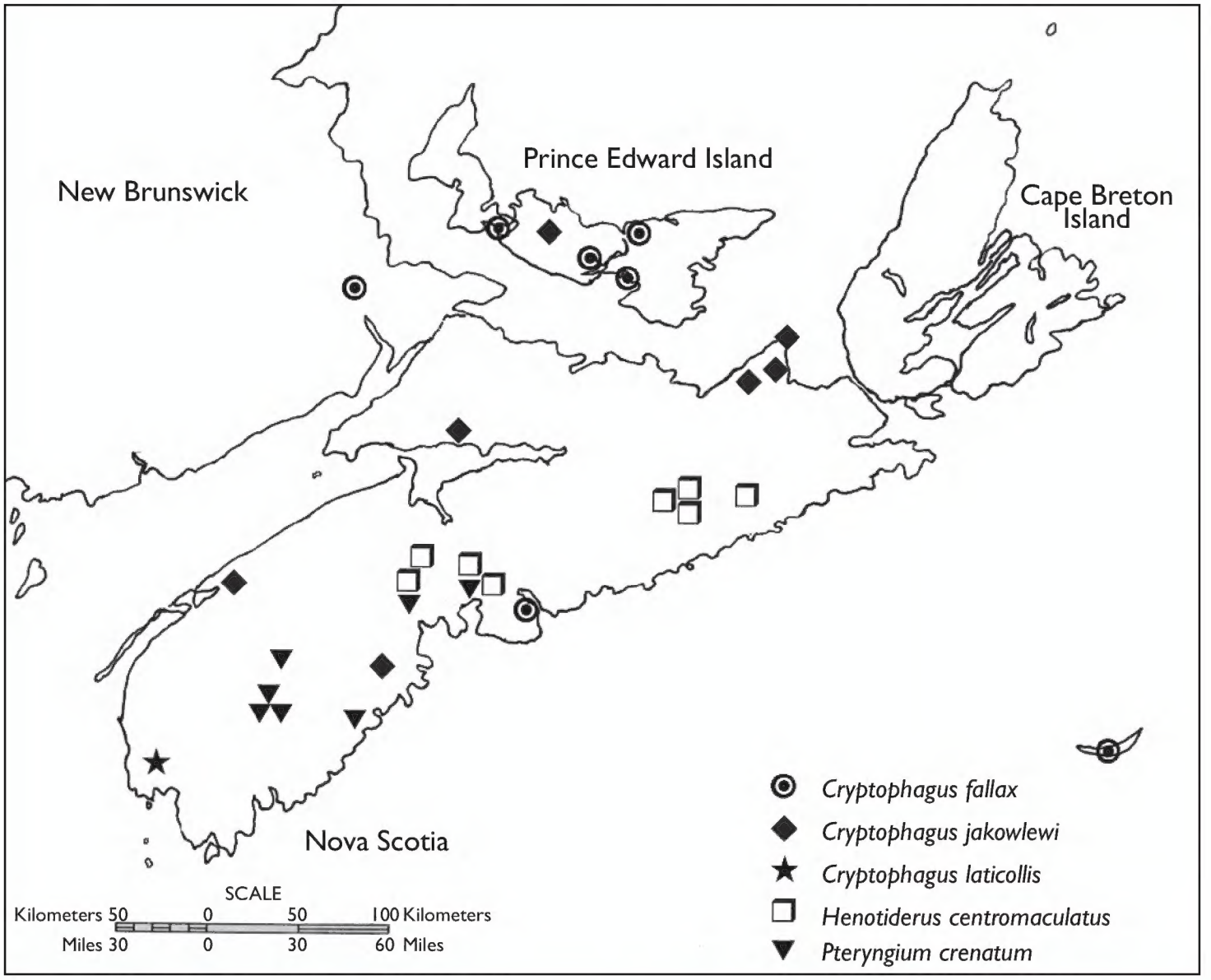

Figure 2. Distribution of *Cryptophagus fallax, C. jakowlewi, C. laticollis, Henotiderus centromaculatus,* and *Pteryngium crenatum* in Atlantic Canada.

Scotia (Howden 1970), and Prince Edward Island (CAIPR 1973). The above record from Halifax also establishes the presence of this species on the mainland of Nova Scotia. It is an adventive species in North America and is found in the Palaearctic region throughout Europe, east through the Caucuses to Kazakhstan and Uzbekistan, and south to Egypt (Johnson et al. 2007). All the specimens collected in this region have been found in buildings on stored products except for two collected on Sable Island in an Ipswich Sparrow (*Passerculus sandwichensis princeps* Maynard) nest (Howden 1970). The narrow quadrate pronotum (compared to the enlarged, convex elytra), and the large pronotal callosities with their face turned upwards, make this a distinctive species amongst the North American fauna (Woodroffe and Coombs 1961).

Cryptophagus histricus Casey, 1900

Cryptophagus histricus was reported by Woodroffe and Coombs (1961) from a bumblebees' nest in Tallik Nagvak Fjord in northern Labrador (Fig. 6). This is the only record of this Nearctic species in the region. It is otherwise recorded from scattered states in

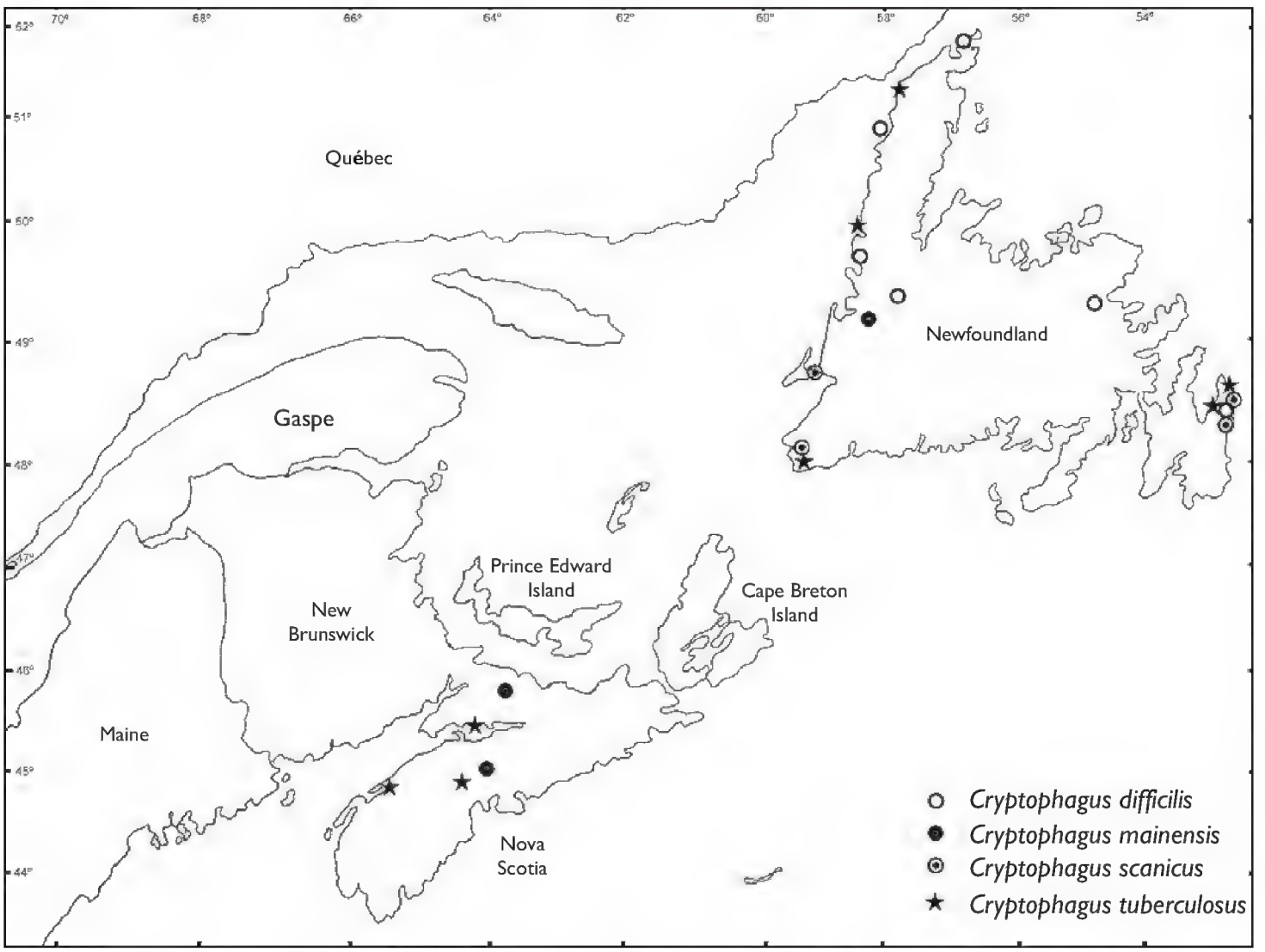

Figure 3. Distribution of *Cryptophagus difficilis, C. mainensis, C. scanicus,* and *C. tuberculosus* in Atlantic Canada.

western and eastern portions of the continent. Other records are from fungi, on cord wood, and in malt (Woodroffe and Coombs 1961).

Cryptophagus jakowlewi Reitter, 1888

NOVA SCOTIA: Antigonish Co.: Cape George, June 23, 1994, M. LeBlanc (1, NSNR); Fairmont Tower Rd, June 16, 1994, M. LeBlanc (1, NSNR); Fairmont Tower Rd, May 17, 1995, M. LeBlanc (1, NSNR); Fairmont Tower Rd, July 6, 1995, M. LeBlanc (2, NSNR); **Colchester Co.:** Five Islands Park, June 13, 2004, J. Ogden, FIT (1, NSNR); **Lunenburg Co.:** Bridgewater, June 30, 1965, B. Wright, red oak (1, NSMC); **Pictou Co.:** Marshy Hope, June 7, 1995, M. LeBlanc (2, NSNR). **PRINCE EDWARD ISLAND: Queens Co.:** St. Patricks, July 13, 2002, C.G. Majka, old field (1, CGMC).

Cryptophagus jakowlewi is newly recorded in Nova Scotia, Prince Edward Island, and Atlantic Canada (Fig. 2). Nearctic specimens of this species were previously known under the name of *Cryptophagus confertus* Casey, 1900 (synonymized by Johnson et al. 2007). It is a Holarctic species found across Canada and the northern United States, in Europe in the Alps and Scandinavia, across Siberia to the Russian Far East, and south

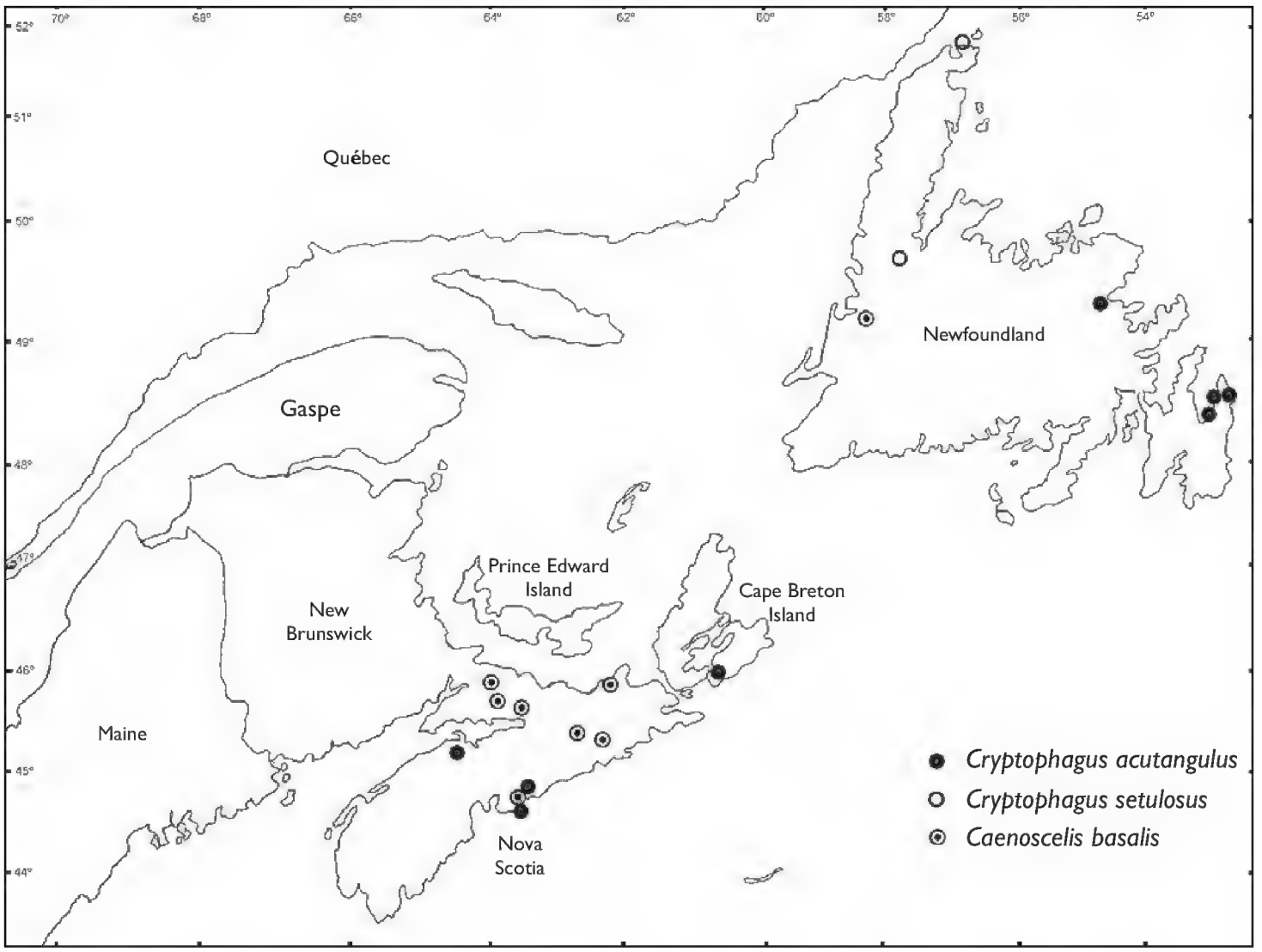

Figure 4. Distribution of *Cryptophagus acutangulus, C. setulosus,* and *Caenoscelis basalis,* in Atlantic Canada.

to Mongolia, Inner Mongolia, and Central Asia. In Europe, Lohse (1967) describes it as a boreo-alpine species. Some specimens of this species can be separated from *Cryptophagus bidentatus* Mäklin on the basis of external morphology only with great difficulty. The adeagi of both species are indistinguishable, however, the shape of the parameres of the two species are quite distinct (Woodroffe and Coombs 1961).

Cryptophagus laticollis Lucas, 1846

NOVA SCOTIA: Yarmouth Co.: Carleton, Perry Rd, July 18, 1993, J. & T. Cook, car netting (1, JCC).

Cryptophagus laticollis is newly recorded in Nova Scotia and eastern North America (Fig. 2). It is an adventive Palaearctic species, previously recorded in North America from the west coast in British Columbia, Alberta, California, Oregon, and Washington (Woodroffe and Coombs 1961; Bousquet 1991). It is a cosmopolitan species found throughout the Palaearctic in Europe, North Africa, and Asia, and in Australia, sub-Saharan Africa, and the Orient (Johnson et al. 2007). It is found on stored products and in vegetable refuse (Woodroffe and Coombs 1961). The small conical eyes of *C. laticollis* distinguish this species from the similar *Cryptophagus setulosus* (Woodroffe and Coombs 1961).

Cryptophagus mainensis Casey, 1924

NEWFOUNDLAND: Steady Brook, July 10, 1949, E. Palmen (2, MZHF). **NOVA SCOTIA: Cumberland Co.:** Westchester-Londonderry, August 22, 1992, S. & J. Peck, forest road, car netting (1, JCC); **Hants Co.:** Panuke Lake, 16–29 July, 1997, D.J. Bishop, red spruce/eastern hemlock (old growth), FIT (1, NSMC); Panuke Lake, 29 July-13 Aug, 1997, D.J. Bishop, red spruce (45 years), FIT (1, NSMC); Panuke Lake, 29 July-13 Aug, 1997, D.J. Bishop, red spruce (45 years), FIT (1, NSMC).

Cryptophagus mainensis is newly recorded in insular Newfoundland, Nova Scotia, and Canada as a whole (Fig. 3). This is a Nearctic species previously known only from Maine, New Hampshire, New York, and Ohio (Woodroffe and Coombs 1961; Chandler 2001). In Nova Scotia specimens were collected in red spruce (*Picea rubens* Sarg., Pinaceae) and mixed eastern hemlock (*Tsuga canadensis* (L.) Carr., Pinaceae) and red spruce forests varying in age from old growth (120+ years) to 45 years. This is the first habitat information about this species. It is a very distinctive species on account of its small size (1.5–1.7 mm.) and very large pronotal callosities which subtend 1/3 of the lateral margin of the pronotum.

Cryptophagus scanicus (Linnaeus, 1758)

NEWFOUNDLAND: Goulds, September 27, 1982 (1, AAFC); St. John's, June 9, 1949, W.J. Brown (5, AAFC); Stephenville, 9 mi. west, August 17, 1981, D. Langor, bog pools (1, AAFC); Upper Ferry, August 18, 1981, D. Langor (6, MUN).

Cryptophagus scanicus was reported in North America by Woodroffe and Coombs (1961) from the five specimens collected in St. John's in 1949 by W.J. Brown. Additional records are given indicating that the species is established and occurs more widely in southern Newfoundland (Fig. 3). It is an adventive Palaearctic species found throughout Europe, in parts of North Africa, across Siberia to the Russian Far East, and in Turkey and Iran in the Middle East. It is also found in sub-Saharan Africa (Johnson et al. 2007). In Europe, it is found in various habitats including stored produce (Woodroffe and Coombs 1961).

Cryptophagus setulosus Sturm, 1845

LABRADOR: Mealy Mts, July, 2002, Anions, Sutton & Quicke (1, MUN); Middle Brook, June 2–17, 2005, June 17-July 4, 2005, July 4–18, 2005, July 18–2 August, 2005, S. Pardy, boreal forest, pitfall (18, MUN); Muskrat Falls, June 2–17, 2005, June 17-July 5, 2005, S. Pardy, boreal forest, pitfall (5, MUN); Ossak Camp, June 28-July 11, 2004, July 11-August 11, 2004, August 11–29, 2004, August 29-September 22, 2004, September 22-October 8, 2004, S. Pardy, subarctic black spruce forest, pitfall (10, MUN); Red Bay, July 4–20, 2004, July 20-August 6, 2004, August 6–23, 2004, August 23-September 2,

2004, S. Pardy, coastal barrens, heath, pitfall (12, MUN); St. Lewis, July 22-August 10, 2004, August 10–25, 2004, August 25-September 7, 2004, S. Pardy, coastal barrens, heath, pitfall (10, MUN). **NEWFOUNDLAND:** Burnt Cape, July 10–24, 2003, A.M. Hynes, crowberry lawn, pitfall (1, MUN); Burnt Cape, July 10–24, 2003, A.M. Hynes, cow parsnip patch, pitfall (1, MUN); Deer Lake, 7 km NE Cormack, July 23-August 18, 1997, S. & J. Peck, mixed, FIT (1, MUN); Gambo, August 26, 1949, E. Palmen (1, MZHF).

Cryptophagus setulosus is newly recorded on insular Newfoundland (Fig. 4). It was previously recorded by Woodroffe and Coombs (1961) from one specimen collected in Labrador. Additional records above indicate that it is abundant and widespread in southern Labrador (Fig. 6). There are scattered records of this species from a number of Canadian and American provinces and states. Woodroffe and Coombs (1961) refer to it as a possibly Holarctic species, while Bousquet (1991) lists it as Holarctic. Woodroffe and Coombs (1961) noted that in Europe this species occurs on stored produce and it is possible that its North American distribution may have been influenced by commercial activities. In the Palaearctic region it is found throughout Europe, in Algeria and Morocco in North Africa, and in Turkey and Central Asia north to Eastern Siberia (Johnson et al. 2007). In Europe it is most frequently found in nests of bees and wasps, but also in fungi and on stored produce (Woodroffe and Coombs 1961).

Cryptophagus tuberculosus Mäklin, 1853

NEWFOUNDLAND: Cow Head, August 13, 1949, E. Palmen (2 females, MZHF); Portugal Cove: Indian Meal Line, August 18, 1986, September 15, 1986 (2, MUN); Portugal Cove: Indian Meal Line, May 16, 1979 (1, AAFC); St. Barbe, July 26, 1949, E. Palmen (1 male, 2 females, MZHF); St. John's, September 15, 1995, October 11, 1996, Biology 4150 (3, MUN); Upper Ferry, August 18, 1981, D. Langor (1, MUN). **NOVA SCOTIA: Annapolis Co.:** Annapolis Royal, July 30, 1941, H.T. Stultz, dried corn (1, ACNS); **Lunenburg Co.:** New Ross, August 1, 1990, M. Russell, in plastic wrapping on hay ladder (1, NSMC); **Colchester Co.:** Five Islands, June 16, 1995, C. Corkum, young coniferous forest, FIT (1 male, NSMC).

Cryptophagus tuberculosus is newly recorded on insular Newfoundland, in Nova Scotia, and in Atlantic Canada (Fig. 3). This Holarctic species has previously recorded in North America from Alaska, Alberta, Arizona, British Columbia, California, Colorado, Idaho, New Mexico, Oregon, Utah, Washington, and Wyoming in western North America (Woodroffe and Coombs 1961), and in Maine and New Hampshire in eastern North America (Chandler 2001). In the Palaearctic region it is found in Scandinavia and northern Russia, east to the Russian Far East, Mongolia, and Inner Mongolia (Johnson et al. 2007). Woodroffe and Coombs (1961) reported it from coniferous trees, nests, and stored produce (especially dried fruit). In Nova Scotia it has been found on dried corn and in a coniferous forest. This is a highly variable, polytypic species which can be difficult to separate from *Cryptophagus subfumatus* Kraatz. The shape of the parameres, however, are quite distinctive (Woodroffe and Coombs 1961).

The occurrence of *C. tuberculosus* in eastern North America is noteworthy. Woodroffe and Coombs (1961) drew attention to the wide Holarctic distribution of this species and its apparent absence in eastern North America. They also noted three "forms" of this species in western North America and suggested that the species was rather easily isolated by geographical or ecological barriers. They further proposed that the species may have dispersed to North America at a time when a land bridge existed across the Bering Strait. Therefore, the occurrence of *C. tuberculosus* in eastern North America may suggest that this species has a typical Holarctic distribution.

Henoticus serratus (Gyllenhal, 1808)

NEWFOUNDLAND: Bishop's Falls, August 12, 1979, E. John (1, AAFC); Bonne Bay, Woody Point, July 16, 1949, E. Palmen (1, MZHF); Catamaran Park, 10 mi. north, July 3, 1985 (1, CFS); Gander, July, 1979 (1, MUN); Gander, July 14, 1981, R.F. Morris, hospital operating room (1, AAFC); Glide Lake, July 5, 1994, W. Bowers et al. (1, CFS); Little Grand Lake, 2 km east of Martin Pond, June 8-July 13, 1993, pitfall (1, MUN); Rocky Harbour, Gros Morne National Park, July 24-August 17, 1994, S. & J. Peck, mixed forest, FIT (2, MUN); Rencontre West, June 17–19, 1949, C.H. Lindroth (1, MZHF); South Branch, July 2, 1949, C.H. Lindroth (1, MZHF); South Branch, July 2, 1949, E. Palmen (1, MZHF). **NOVA SCOTIA: Guysborough Co.:** Dayspring Lake, 29 July-13 Aug, 1997, D.J. Bishop, red spruce, FIT (1, NSMC); **Lunenburg Co.:** Bridgewater, July 1–16, 1965, B. Wright, red oak forest, pitfall trap (1, NSMC); **Queens Co.:** Ponhook Lake, July 13, 1993, J. Cook, uv light trap (11, JCC); **Yarmouth Co.:** Carleton, Perry Rd, July 18, 1993, J. & T. Cook, car netting (1, JCC).

Henoticus serratus is newly recorded in insular Newfoundland and Nova Scotia (Fig. 1). Downie and Arnett (1996) reported the species from Labrador, although it is not clear where this record originates. Bousquet (1991) reported the species from Alaska and British Columbia east to Québec, and Downie and Arnett (1996) reported records from a variety of eastern and western states in the USA. In the Palearctic region this Holarctic species is found throughout Europe (except for the Iberian peninsula, the southern Balkans and the Mediterranean islands) southeast to Georgia, and east across Siberia to the Russian Far East (Johnson et al. 2007). All the specimens collected in Atlantic Canada are from wild habitats such as red spruce and red oak (*Quercus rubra* L., Fagaceae) forests. Blatchley (1910) reported it from dry fungi about the stumps of oaks. Bousquet (1989) noted that adults in the genus *Henoticus* are usually found in leaf litter, fungi, under the bark of dead or dying trees, and on leaves of trees or shrubs.

Henotiderus centromaculatus Reitter, 1877

Henotiderus centromaculatus was recorded from Nova Scotia by Bousquet (1991) (as *H. obesulus)*. There are scattered records from the central part of mainland Nova Scotia

(Fig. 2). This Nearctic species has been recorded from Alaska and across Canada from the Northwest Territories east to Nova Scotia, and in New Hampshire and New York (Bousquet 1991; Downie and Arnett 1996; Chandler 2001). It is also found in the Eastern Palaearctic in China, Japan, and the Russian Far East (Johnson et al. 2007). Species of *Henotiderus* are found in leaf litter or associated with polypore fungi such as *Polyporus*, *Pleurotus*, and *Fomes* in forested habitats (Bousquet 1989). All the specimens collected in Nova Scotia were found in red spruce forests, varying in age from young to old growth, except for one specimen collected in a mixed red spruce-eastern hemlock forest (unpublished data).

Pteryngium crenatum (Gyllenhal, 1808)

NOVA SCOTIA: Annapolis Co.: Durland Lake, May 21, 2003, P. Dollin, hemlock/balsam fir/black spruce (120+ years): bracket fungus (1, NSMC); Durland Lake, May 21, 2003, P. Dollin, hemlock/balsam fir/black spruce (120+ years): bracket fungus (1, NSMC); **Halifax Co.:** Big Indian Lake, June 23, 2003, P. Dollin, red spruce (80–120), funnel trap (1, NSMC); Big Indian Lake, July 16, 2003, P. Dollin, red spruce (80–120 years), funnel trap (1, NSMC); Big Indian Lake, June 23, 2003, P. Dollin, red spruce (80–120 years): belted bracket fungus (2, NSMC); **Lunenburg Co.:** Card Lake, 2–15 June, 1997, D.J. Bishop, red spruce/hemlock (old growth forest), FIT (1, NSMC); **Queens Co.:** Black Duck Lake, June 9, 2003, P. Dollin, white pine/red spruce (40–80 years): underside of bracket fungus (1, NSMC); Eight Mile Lake, June 5, 2003, P. Dollin, red spruce (40–80 years): belted bracket fungi (1, NSMC); Sixth Lake, June 18, 2003, P. Dollin, hemlock (120+ years) (1, NSMC); Tobeatic Lake, June 17, 2003, P. Dollin, red spruce (80–120 years) (1, NSMC).

Pteryngium crenatum is newly recorded in Nova Scotia and Atlantic Canada (Fig. 2). This species has previously been recorded in North America from British Columbia, Indiana, New Hampshire, Oregon, Québec, and Washington (Bousquet 1991; Downie and Arnett 1996; Chandler 2001). It is an adventive Palaearctic species found throughout Europe (Johnson et al. 2007). In Nova Scotia, all the specimens were collected in coniferous forests, most on bracket fungi (Polyporaceae).

Telmatophilus americanus LeConte, 1863

NEWFOUNDLAND: St. John's, Oxen Pond Botanical Park, September, 2000, S. Lilly, Biology 4150 (1, MUN). **NEW BRUNSWICK: Albert Co.:** Mary's Point, August 21, 2003, C.G. Majka, coastal marsh (1, CGMC); **York Co.:** Canning-Scotchtown, June 25, 2003, R.P. Webster, oak forest, at light (1, RPWC). **NOVA SCOTIA: Cumberland Co.:** Amherst, June 6, 1993, J. Ogden (1, NSNR); Amherst, June 24, 1994, J. Ogden (1, NSNR); Amherst Marsh, July 24, 1989, J. Ogden, marsh plants, sweep netting (6, NSNR); Amherst Marsh, June 11, 1993, J. Ogden, marsh

plants, sweep netting (1, NSNR); **Pictou Co.:** McLellan's Brook, June 16, 1988, E. Georgeson (1, NSMC).

Telmatophilus americanus is newly recorded in insular Newfoundland, New Brunswick and Nova Scotia (Fig. 1). It has previously been recorded in Canada from British Columbia to Québec, south to Colorado, Indiana, and New York in the United States (Bousquet 1991; Downie and Arnett 1996). It is found on the flowers of *Sparganium* spp. (Sparganiaceae) (Hatch 1961; Leshen and Skelley 2002). Blatchley (1910) also reported it from arrow arum (*Peltandra virginica* L., Araceae). Both *Sparganium fluctuans* (Morong) B.L. Robins and *S. angustifolium* Michx. (Sparganiaceae) occur in the area of the Oxen Pond Botanical Park where *T. americanus* was collected in Newfoundland (Todd Boland, pers. comm.).

Telmatophilus typhae (Fallén, 1802)

NOVA SCOTIA: Colchester Co.: Debert, April 21, 1993, J. Ogden (1, NSNR); Debert, May 14, 1993, J. Ogden (1, NSNR); Debert, May 14, 1993, J. McPhee, funnel trap (1, NSNR); Debert, May 21, 1993, J. Ogden, grasses, sweep netting (1, NSNR); Masstown, May 6, 1993, J. C. McPhee (1, NSNR); Masstown, April 14, 1993, J. Ogden (1, NSNR); **Cumberland Co.:** Amherst, June 24, 1994, J. Ogden (1, NSNR); Amherst Marsh, July 24, 1989, J. Ogden, marsh plants, sweep netting (1, NSNR); Westchester-Londonderry, July 20, 1992, S. & J. Peck, forest road, car netting (2, JCC); **Guysborough Co.:** Trafalgar, July 19, 1992, S. & J. Peck, car netting (2, JCC); **Halifax Co.:** Conrod Island, July 23, 1986, B. Wright (1, NSMC); **Inverness Co.:** Cheticamp, June 25, 1994, V. Jessome (1, CBU); **Queens Co.:** Medway River, July 13, 1993, J. & T. Cook, car netting (1, JCC).

Telmatophilus typhae was reported in North America from New Brunswick, Nova Scotia, and Prince Edward Island by Hoebeke and Wheeler (2000) (Fig. 5). The specimens collected by Hoebeke and Wheeler (2000) were from 1995 and 1997. It is an adventive Palaearctic species known in North America only from these three provinces. The above records establish the presence of this species in Nova Scotia, and hence North America, from as early as 1986. In the Palaearctic region it is found throughout Europe and in the Russian Far East, Japan, North Korea, and China. In North America it is found on the male flowers of cattails, *Typha latifolia* L. and *Typha angustifolia* L. (Typhaceae).

Caenoscelis basalis Casey, 1900

NEWFOUNDLAND: Corner Brook, Loggers Sch Rd, July 29-August 21, 1992, 60 year old fir forest, pitfall (2, MUN). **NOVA SCOTIA: Colchester Co.:** Debert, June 19, 1993, J. Ogden (1, NSNR); **Cumberland Co.:** Oxford, May 25, 1995, J. Ogden (1, NSNR); Westchester-Londonderry, July 20, 1992, S. & J. Peck, forest

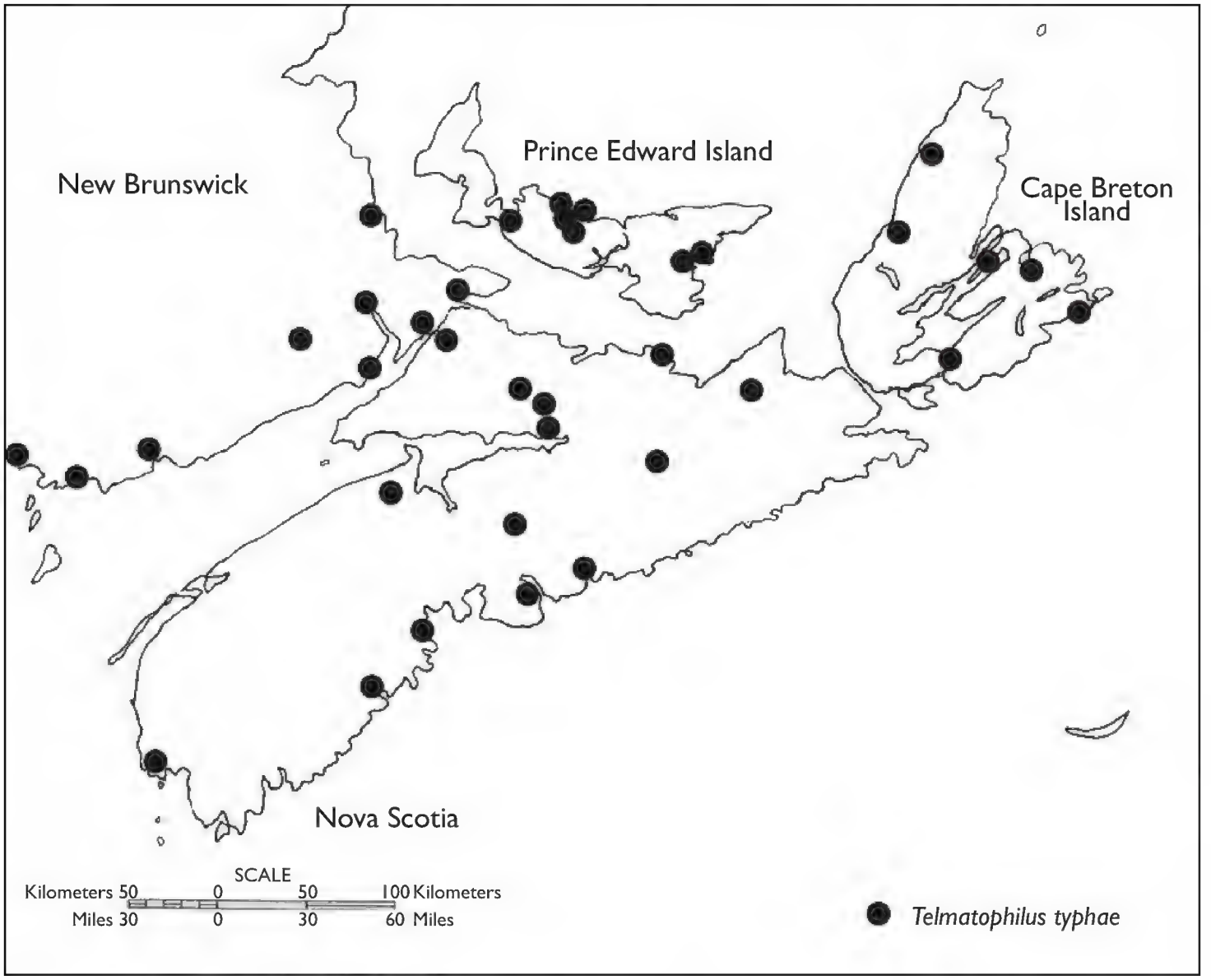

Figure 5. Distribution of *Telmatophilus typhae* in Atlantic Canada.

road, car netting (2, JCC); **Guysborough Co.:** Malay Lake, 1–16 July, 1997, D.J. Bishop, red spruce, FIT (1, NSMC); Trafalgar, July 19, 1992, S. & J. Peck, car netting (1, JCC); **Halifax Co.:** Point Pleasant Park, June 22, 1990, R. Ballard, red spruce forest, pipe trap (2, NSMC); **Pictou Co.:** Marshy Hope, August 10, 1995, M. LeBlanc, FIT (1, NSNR).

Caenoscelis basalis is newly recorded in Newfoundland, Nova Scotia, and Atlantic Canada (Fig. 4). Previous records of this Holarctic species are from Maine, New Hampshire, New York, and Québec (Bousquet 1991; Downie and Arnett 1996; Chandler 2001). Specimens in Nova Scotia were collected in red spruce forests, and in Newfoundland it was found in a balsam fir (*Abies balsamaea* (L.) Mill, Pinaceae) forest. Members of this genus are found in leaf litter, organic matter, nests of small mammals, and beneath the bark of logs (Bousquet 1989).

Discussion

Eighteen species of Cryptophaginae are now known to occur in Atlantic Canada. Eight of these including *Cryptophagus difficilis*, *C. jakowlewi*, *C. laticollis*, *C. mainensis*, *C.*

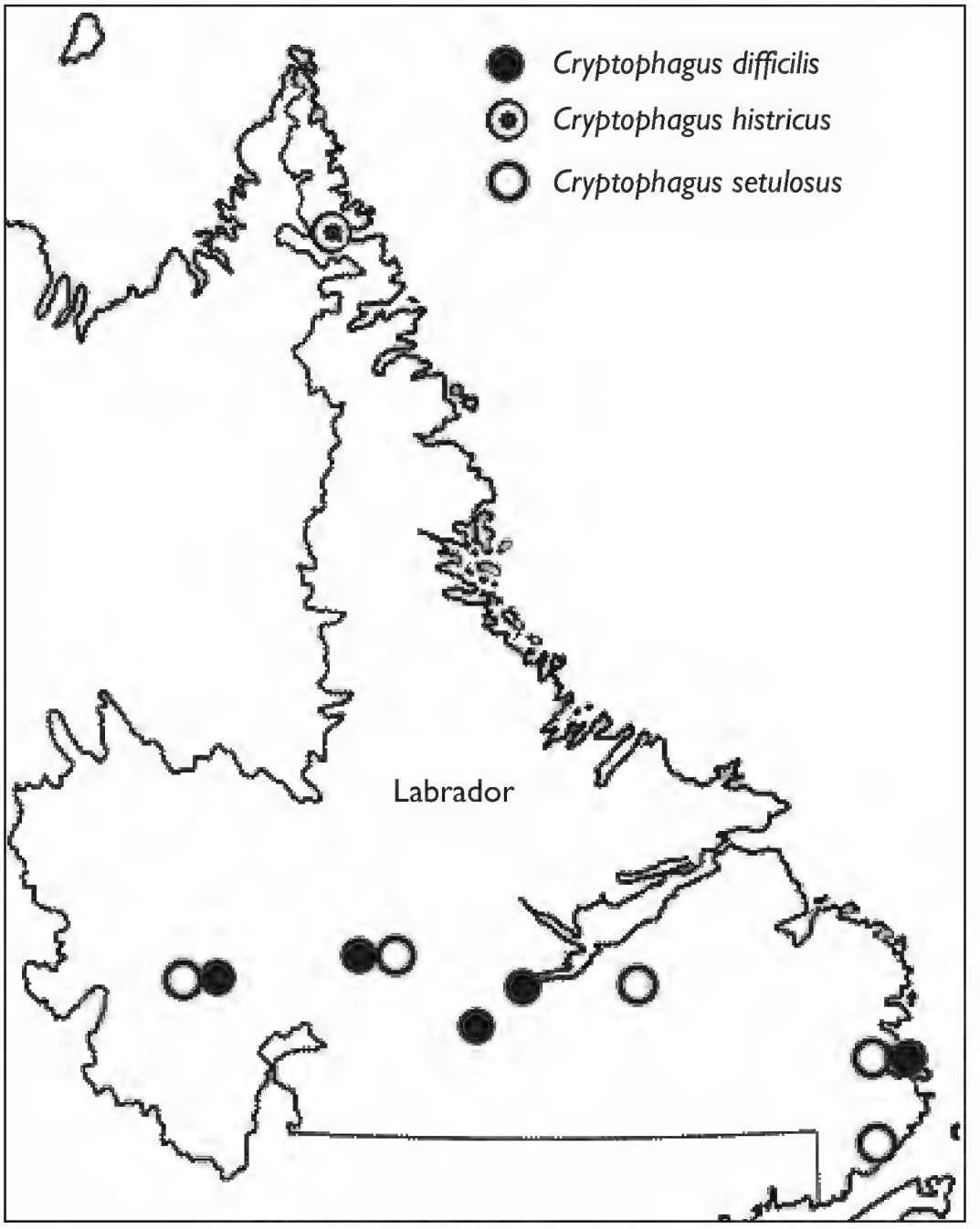

Figure 6. Distribution of *Cryptophagus difficilis, C. histricus,* and *C. setulosus* in Labrador.

tuberculosus, *Pteryngium crenatum*, *Telmatophilus americanus*, and *Caenoscelis basalis* are newly recorded in Atlantic Canada; one of which, *C. mainensis*, is newly recorded in Canada, and another, *C. laticollis*, is newly recorded in eastern North America. Nineteen new provincial records are reported (Table 1). These records increase the known fauna of Atlantic Canada by more than 40% and more than double the number of provincial records. Nonetheless, it is clear that knowledge of this group in the region is still far from adequate. Voucher specimens are lacking for records of *Antherophagus convexulus* in New Brunswick and *Henoticus serratus* in Labrador. Although 14 species of Cryptophaginae have been recorded in Nova Scotia, only five have been found in New Brunswick. This small number of records from the latter province undoubtedly reflects a lack of collecting effort for this family there. Although six species of *Cryptophagus* have been found in Nova Scotia, all are represented by a small number of specimens, and only one (*C. acutangulus*) has been collected on Cape Breton Island. Except for *Antherophagus ochraceus* and *Telmatophilus typhae,* the recorded distribution of all other species is scattered and local, almost certainly the result of insufficient collecting.

Although collecting effort for this group in the region is still far from adequate, some preliminary observations can be made. *Cryptophagus difficilis* and *C. setulosus* are abundant species in insular Newfoundland and Labrador (particularly in the latter region), and are completely absent from the Maritime Provinces of Canada (the provinces of New Brunswick, Nova Scotia, and Prince Edward Island). In general, species of *Cryptophagus* are rather seldom collected in the Maritimes, yet the above two species are abundant and frequently collected in Newfoundland and Labrador; apparently reflective of differences between the forest micro-habitats of the Atlantic Maritime Ecozone on the one hand, and the Boreal Shield and Taiga Shield Ecozones characteristic of Newfoundland and Labrador on the other. *Cryptophagus histricus* has also been recorded in Labrador, although this study did not find further specimens. Conversely native species such as *Antherophagus convexulus, Cryptophagus jakowlewi,* and *Henotiderus centromaculatus,* which have been recorded from a number of localities in Nova Scotia (and Prince Edward Island in the case of *C. jakowlewi*), have not been found in Newfoundland and Labrador.

Although islands in general are characterized by a diminished fauna, the number of native cryptophagines recorded from Prince Edward Island (2 species; *A. ochraceus* and *C. jakowlewi*) and Cape Breton Island (3 species; *A. convexulus, A ochraceus,* and *T. americanus*) is very low. This may in part be due to insufficient collecting effort in these areas.

Five of the 18 species (27%) of the fauna consists of adventive species. The dates of earliest detection of these species are shown in Table 2, although it is likely that these species have been present (and undetected) for substantially longer. Note that two of these five species were first detected in North America in Atlantic Canada. Records from this region indicate that except for *Cryptophagus fallax*, which has been found solely in association with stored products in synanthropic situations, all four other adventive species (*C. laticollis, C. scanicus, Pteryngium crenatum,* and *Telmatophilus typhae*) are all established in wild habitats.

The adventive species, *Telmatophilus typhae,* was first recorded in North America by Hoebeke and Wheeler (2000) from specimens collected in 1995 and 1997. The present account includes a record from 1986, pushing back the date of first detection of this species on the continent by nine years. The very extensive distribution of this species in New Brunswick, Nova Scotia, and Prince Edward Island would appear to indicate that it has been present for much longer, or that its rate of dispersal has been very rapid. The first author has found it to be present everywhere that he has looked

Table 2. Earliest dates of detection of adventive species in Atlantic Canada

	NB	NS	PE	NF	North America	Source
Cryptophagus fallax	1982	1967	1973		?	Woodroffe and Coombs (1961)
Cryptophagus laticollis		1993			1900	Casey (1900)
Cryptophagus scanicus				1949	1949	present study
Pteryngium crenatum	1997				1900	Casey (1900)
Telmatophilus typhae	1997	1986	1995		1986	present study

for it where its host plants (*Typha latifolia* and *T. angustifolia)* are found. Since *T. typhae* has been found adjacent to the American border in St. Stephen, NB (Hoebeke and Wheeler 2000), it almost certainly is present in eastern Maine and should be looked for in that state.

Pteryngium crenatum, while reported to be an adventive species in North America, has been collected in a number of jurisdictions in Canada from British Columbia to Nova Scotia, south to Indiana and New Hampshire. Records in Nova Scotia are exclusively from wild habitats, in coniferous forests associated with Polyporaceae. Given this distribution and the non-synanthropic environments where it is found, the status of this species in North America should be further investigated to ascertain if it might be a native Holarctic species.

Four native *Cryptophagus* species, *C. histricus, C. difficilis, C. jakowlewi,* and *C. mainensis*, have been recorded only in wild habitats. *Cryptophagus acutangulus, C. laticollis, C. scanicus, C. setulosus*, and *C. tuberculosus*, including both Holarctic and adventive Palaearctic species, are known from both wild habitats as well as being associated with stored products. It appears that the species in this group have considerable ecological plasticity. The adventive, Palaearctic *Cryptophagus fallax* is known primarily from stored products. All other cryptophagines found in Atlantic Canada occur (at least in part) in wild habitats.

Generally cryptophagines are ecologically diverse. Species such as *Cryptophagus difficilis, C. mainensis, Henoticus serratus, Henotiderus centromaculatus, Pteryngium crenatum,* and *Caenoscelis basalis* are associated with decomposing wood and fungi, and are components of the region's saproxylic fauna. *Antherophagus convexulus, A. ochraceus, Cryptophagus histricus*, and *C. setulosus* are exclusively or frequently associated with bumblebee or other Hymenoptera nests where they apparently feed on organic detritus. *Telmatophilus americanus* and *T. typhae* feed on pollen of marsh plants.

Further research is clearly indicated in order to gain a better understanding of cryptophagines in Atlantic Canada.

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References

Blatchley WS (1910) An illustrated descriptive catalogue of the Coleoptera or beetles (exclusive of the Rhynchophora) known to occur in Indiana. The Nature Publishing Company, Indianapolis, Indiana, 1386 pp.

Bousquet Y (1989) A review of the North American genera of Cryptophaginae (Coleoptera: Cryptophagidae). The Coleopterists Bulletin 43(1): 1–17.

Bousquet Y (1991) Family Cryptophagidae: silken fungus beetles. In: Bousquet Y (Ed) Checklist of Beetles of Canada and Alaska. Agriculture Canada: Research Branch Publication 1861/E, 221–223.

CAIPR (1973) Canadian Agricultural Insect Pest Review, Vol. 51. Research Branch, Agriculture Canada, Ottawa, Ontario.

Casey TL (1900) A review of the American Corylophidae, Cryptophagidae, Tritomidae and Dermestidae, with other studies. Journal of the New York Entomological Society 8: 51–172.

Chandler DS (2001) University of New Hampshire Insect and Arachnid Collections. http://insectcoll.unh.edu/ [accessed 21.VIII.2009].

Downie NM, Arnett RH, Jr (1996) The Beetles of Northeastern North America. Sandhill Crane Press. Gainsville, Florida, 1721 pp.

Evenhuis NL (2009) Abbreviations for insect and spider collections of the world. http://hbs.bishopmuseum.org/codens/codens-inst.html [accessed 21.VIII.2009].

Hatch MH (1961) The beetles of the Pacific Northwest, Part III: Pselaphidae and Diversicornia I. University of Washington Press, Seattle, Washington, 503 pp.

Hoebeke ER, Wheeler AG, Jr (2000) *Telmatophilus typhae* (Fallén) (Coleoptera: Cryptophagidae), a Palaearctic cattail specialist established in the Canadian Maritime Provinces. Proceedings of the Entomological Society of Washington 102: 398–402.

Howden HF (1970) The Coleoptera. In: Howden HF, Martin JEH, Bousfield EL, McAllister DE (Eds) Fauna of Sable Island and its zoogeographic affinities. National Museums of Canada Publications in Zoology 4: 1–30.

Johnson C, Otero JC, Leschen RAB (2007) Cryptophagidae Kirby, 1837. In: Löbl I, Smetana A (Eds) Catalogue of Palaearctic Coleoptera, Volume 4: Elateroidea, Derontoidea, Bostrichoidea, Lymexyloidea, Cleroidea, Cucujoidea. Apollo Books, Stenstrup, Denmark, 513–531.

Laplante S, Bousquet Y, Bélanger P, Chantal C (1991) Liste des espèces de coléoptères du Quebec. Fabreries Supplement 6, 136 pp.

Leschen AB, Skelley PE (2002) Cryptophagidae Kirby 1837. In: Arnett RH, Jr, Thomas MC, Skelley PE, Frank JH (Eds) American Beetles, Volume 2: Polyphaga: Scarabaeoidea through Curculionoidea. CRC Press, Boca Raton, 338–342.

Lohse GA (1967) Fam. Cryptophagidae. In: Freude H, Harde KW, Lohse GA. (Eds) Die Käfer Mitteleuropas, Band 7: Clavicornia. Goecke & Evers, Krefeld, 110–157.

Procter W (1946) Biological Survey of the Mount Desert Region, Part VII: The Insect Fauna. Wistar Institute of Anatomy and Biology, Philadelphia, Pennsylvania, 566 pp. http://www.biodiversitylibrary.org/item/29157 [accessed 4.VIII.2009].

Woodroffe GE, Coombs CW (1961) A revision of the North American *Cryptophagus* Herbst (Coleoptera: Cryptophagidae). Miscellaneous Publications of the Entomological Society of America 2: 179–211.